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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,393	09/27/2006	Janet E. Hails	124-1174	9262

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EXAMINER	
ENAD, CHRISTINE A	

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2823	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/594,393	HAILS ET AL.	
	Examiner	Art Unit	
	CHRISTINE ENAD	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 September 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29 and 31-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29 and 31-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/27/2006; 3/30/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application.
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 9, 27 are rejected under 35 U.S.C. 102 (b) as being anticipated by Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)).

In re claim 1, Nouhi discloses a method of growing mercury cadmium telluride, Hg 1-x Cd x Te where x is 0 <=x<=1, comprising the steps of; a) taking a crystalline substrate (Column 2, lines 29-30), b) growing at least one buffer layer on said substrate by molecular beam epitaxy (Column 2, lines 29-30), and c) growing at least one layer of mercury cadmium telluride on said at least one buffer layer by metal-organic vapour phase epitaxy (Column 2, lines 21-22 and Column 3, lines 11-20).

In re claim 2, Nouhi discloses the substrate is chosen from the group consisting of cadmium telluride, zinc telluride, cadmium zinc telluride, gallium arsenide, silicon, germanium, indium antimonide, indium aluminum antimonide, indium gallium antimonide, indium phosphide, sapphire, cadmium zinc selenide, cadmium zinc selenide telluride, alumina or spinel (Column 2, lines 29-30).

In re claim 3, Nouhi discloses the substrate is silicon (Column 2, lines 29-30).

In re claim 4, Nouhi discloses the step of taking a crystalline substrate includes arranging said substrate to be mis- aligned from the form {100} in either the 111 > or 110> directions (Column 2, lines 28-34).

In re claim 5, Nouhi discloses the degree of mis-alignment of the substrate is between 1-° and 10-° (Column 2, lines 28-34).

In re claim 6, Nouhi discloses the substrate is silicon and wherein said silicon substrate orientation is (001) mis- aligned towards the [111] direction(Column 2, lines 28-34).

In re claim 9, Nouhi discloses prior to the step of growing the at least one layer of cadmium mercury telluride, of cleaning the surface of the uppermost buffer layer grown by molecular beam epitaxy (Column 2, line 36-Column 3, line 3).

In re claim 27, Nouhi discloses prior to growing at least one buffer layer by molecular beam epitaxy, of cleaning/treating the substrate (Column 2, line 36-Column 3, line 3).

Claims 31-36 are rejected under 35 U.S.C. 102 (b) as being anticipated by Johnson S et al (Journal of Electronic Materials, Warrendale, PA, US vol.24, no. 5, 1 May 1995, pages 467-473)

In re claim 31, Johnson discloses an infrared device (Column 1, lines 1-8) comprising a substrate (Column 4, lines 21-40), at least one buffer layer on the substrate and at least one layer of cadmium mercury telluride on the at least one buffer

layer (Column 4, lines 41-47) wherein the substrate orientation is [100] mis-aligned by 1° - 10° inclusive to [110] or [111](Column 4, lines 21-40).

In re claim 32, Johnson discloses the substrate is silicon has an orientation (001) mis-aligned by 1° - 10°inclusive to [111]](Column 4, lines 21-40 Column 12, lines 15-28).

In re claim 33, Johnson discloses the at least one buffer layer comprises one or more layer chosen from zinc telluride, cadmium telluride and cadmium zinc telluride (Column 4, lines 21-40)..

In re claim 34, Johnson discloses an infrared device (Column 1, lines 1-8) comprising a substrate, at least one buffer layer formed on the substrate and at least one layer of cadmium mercury telluride formed on the at least one buffer layer (Column 4, lines 21-40) wherein the at least one layer of cadmium telluride, is tuned to be active at long wave infrared wavelength radiation and wherein the substrate is silicon (Column 11, lines 18-26).

In re claim 35, Johnson discloses the device is a detector (Column 12, lines 28-35).

In re claim 36, Johnson discloses the device is an infrared source (Column 1, lines 1-8) .

Claim 37 is rejected under 35 U.S.C. 102 (b) as being anticipated by Wang et al. (US Patent No. 5,192,695).

In re claim 37, Wang discloses a method of growing at least one crystalline layer of Hg 1-x Cd x Te where 0<=x<=1 comprising the step of taking a substrate **Fig 4A** having at least one mesa device formed in at least one layer of cadmium mercury telluride 16 and growing said at least one layer of Hg 1-x Cd x Te by metal organic vapour phase epitaxy (Column 4, lines 15-34).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 7-8, 10-12, 15-18, 23-26, 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)) in further view of Johnson S et al (Journal of Electronic Materials, Warrendale, PA, US vol.24, no. 5, 1 May 1995, pages 467-473).

In re claim 7, Nouhi discloses all the limitations except for growing more buffer layers. Whereas Johnson discloses the step of growing at least one buffer layer by molecular beam epitaxy comprises the step of growing one or more layers chosen from zinc telluride, cadmium telluride and cadmium zinc telluride (Column 4, lines 21-40). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the buffer layer as taught by Nouhi and incorporate

additional buffer layer to maintain the Si substrate orientation and attain thickness uniformity (Column 12, lines 15-26).

In re claim 8, Johnson discloses the step of growing at least one buffer layer by molecular beam epitaxy comprises the step of growing a layer of zinc telluride on the substrate and growing a layer of cadmium telluride on said zinc telluride layer (Column 4, lines 21-40).

In re claim 10, Johnson discloses after growing at least one buffer layer by molecular beam epitaxy, of growing at least one buffer layer by metal organic vapour phase epitaxy (Column 4, lines 21-40 and Column 5, lines 33-41).

In re claim 11, Johnson discloses at least one buffer layer grown by metal organic vapour phase epitaxy step is the same as a buffer layer grown by molecular beam epitaxy (Column 4, lines 21-40 and Column 5, lines 33-41).

In re claim 12, Johnson discloses the step of growing at least one buffer layer by molecular beam epitaxy comprises growing a top layer of cadmium telluride on a base layer zinc telluride on the substrate the step of growing at least one further buffer layer comprises growing a further cadmium telluride layer by metal organic vapour phase epitaxy (Column 4, lines 21-40 and Column 5, lines 33-41).

In re claim 15, Johnson discloses the step of growing the at least one cadmium mercury telluride layer involves doping at least one of the cadmium mercury telluride layers with a dopant (Column 4, lines 41-47) .

In re claim 16, Johnson discloses the dopant is chosen from iodine, arsenic, indium, phosphorous and antimony (Column 4, lines 41-47) .

In re claim 17, Johnson discloses the step of growing at least one cadmium mercury telluride layer comprises the step of growing a plurality of layers of cadmium mercury telluride, at least some of the layers having a different thickness, composition, dopant and/or dopant concentration (Column 4, lines 41-47 and Column 5, lines 51-60).

In re claim 18, Johnson discloses the method further comprises the step of device processing (Column 4, lines 41-47 and Column 12, lines 38-40).

In re claim 23, Nouhi discloses a method producing a buffered substrate suitable for growth of at least one layer of cadmium telluride by metal organic vapour phase epitaxy the method comprising the steps of taking a crystalline substrate and growing at least one buffer layer by molecular beam epitaxy (Column 2, lines 21-22 and 29-30 and Column 3, lines 11-20). Nouhi discloses all the limitations except for a layer of cadmium mercury telluride (HgCdTe). Whereas Johnson discloses growing a layer or HgCdTe by MOVPE. Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the structure as taught by Nouhi and incorporate and addition layer as was taught by Johnson to produce a LWIR detectors (Nouhi –Column 1, lines 1-22).

In re claim 24, Nouhi discloses the substrate is mis-aligned from {100} in either the 111 > or 110> directions (Column 2, lines 28-34).

In re claim 25, Nouhi discloses the substrate is silicon (Column 2, lines 29-30).

In re claim 26, Nouhi discloses the orientation of the silicon substrate is (001) mis-aligned from 1° to 10° to [111] (Column 2, lines 28-34).

In re claim 29, Nouhi discloses a method of manufacture of cadmium mercury telluride comprising the steps of taking a buffered substrate comprising one or more buffer layers grown on a crystalline substrate by molecular beam epitaxy and growing at least one layer of cadmium telluride by metal organic vapour phase epitaxy. (Column 2, lines 21-22 and 29-30 and Column 3, lines 11-20). Nouhi discloses all the limitations except for a layer of cadmium mercury telluride (HgCdTe). Whereas Johnson discloses growing a layer or HgCdTe by MOVPE. Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the structure as taught by Nouhi and incorporate and addition layer as was taught by Johnson to produce a LWIR detectors (Nouhi –Column 1, lines 1-22).

Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)) in further view of Bevan et al. (US Patent No. 5,838,053).

In re claim 10, Nouhi discloses all the limitations except for growing more buffer layers. Whereas Bevan discloses after growing at least one buffer layer by molecular beam epitaxy, of growing at least one buffer layer by metal organic vapour phase epitaxy (Column 3, line 65-Column 4, line 15 and Column 1, lines 36-45). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention

was made to modify the buffer layer as taught by Nouhi and incorporate additional buffer layer to avoid mismatch between silicon and cadmium telluride (Column 2, lines 22-30).

In re claim 11, Bevan discloses the at least one buffer layer grown by metal organic vapour phase epitaxy step is the same as a buffer layer grown by molecular beam epitaxy(Column 3, line 65-Column 4, line 15 and Column 1, lines 36-45).

Claims 13-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)) in further view of Hails et al. (US Patent No. 7,026,228).

In re claim 13, Nouhi discloses all the limitations except for sequentially growing thin layers of CdTe and HgTe. Whereas Hails discloses the step of growing the at least one cadmium mercury telluride layer comprises sequentially growing thin layers of CdTe and HgTe which interdiffuse during growth to give a single layer of CMT, the relative thicknesses of the CdTe and HgTe layers determining the cadmium content x. (Claim 1 and Column 4, line 64-Column 5, line 8). Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the method of growing cadmium mercury telluride layer to avoid undesirable by products from the precursor (Column 2, lines 37-54).

In re claim 14, Hails discloses di- iso-propyltelluride is the tellurium precursor and dimethylcadmium is the cadmium precursor in the step of growing the at least one cadmium mercury telluride layer by MOVPE (Column 4, lines 1-2).

In re claim 15, Hails discloses the step of growing the at least one cadmium mercury telluride layer involves doping at least one of the cadmium mercury telluride layers with a dopant (Column 6, lines 32-52).

In re claim 16, Hails discloses the dopant is chosen from iodine, arsenic, indium, phosphorous and antimony (Column 6, lines 32-52).

In re claim 17, Hails discloses the step of growing at least one cadmium mercury telluride layer comprises the step of growing a plurality of layers of cadmium mercury telluride, at least some of the layers having a different thickness, composition, dopant and/or dopant concentration (Column 6, lines 34-60).

In re claim 18, Hails discloses the step of device processing (Column 6, lines 34-67).

In re claim 19, Hails discloses the method comprises the step, after the device processing step, of coating the devices with at least one passivating layer (Claim 10).

In re claim 20, Hails discloses the at least one passivating layer comprises cadmium telluride (Claim 10).

In re claim 21, Hails discloses the step of coating the device with a passivating layer comprises growing at least one epitaxial layer grown by metal organic vapour phase epitaxy (Column 3, lines 15-25 and lines 55-61).

In re claim 22, Hails discloses the method involves the step, after the device processing step, of growing further epitaxial layers of cadmium mercury telluride by metal organic vapour phase epitaxy (Column 3, lines 45-67).

Claims 18 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)) in further view of Wang et al. (US Patent No. 5,192,695).

In re claim 18, Nouhi discloses all the limitations except for the device processing. Whereas Wang discloses the step of device processing **Fig 4A.** Therefore it would have been obvious to one having ordinary skill of the art at the time the invention was made to modify the method of Nouhi and incorporate device processing as taught by Wang to manufacture an infrared detector.

In re claim 22, Wang discloses the method involves the step, after the device processing step, of growing further epitaxial layers of cadmium mercury telluride by metal organic vapour phase epitaxy **Fig 4A, 18 and 20.**

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nouhi A. et al. (Applied Physics Letters, American Institute of Physics, NY, US vol 52, no.24 (1988-06-13; pages 2028-2030)) in further view of Sasaki (US Patent No. 5,290,394).

In re claim 28, Nouhi discloses all the limitations except for the arsenic flux. Whereas Sasaki discloses a step of treating the substrate comprises the step of heating the substrate under an arsenic flux (Column 1, lines 15-24). Therefore it would have

been obvious to one having ordinary skill of the art at the time the invention was made to modify the method of cleaning and incorporate arsenic flux to clean/heat the substrate.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTINE ENAD whose telephone number is (571)270-7891. The examiner can normally be reached on Monday - Thursday, 7:30 am - 6:00 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272 1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CHRISTINE ENAD
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